requisite strength, rotate at a speed of 500 revolutions a minute. and in that time will do from 22 to 29 foot pounds of work. The construction is extremely simple. There is a Siemens' armature on a horizontal axis, within, and entirely surrounded by, the fixed electromagnet which not only serves to produce a powerful magnetic field, but also acts as a rigid framework for the rotating parts, which is thus protected from injury. The contact of the wires of the circuit with the commutator is made by two springs with little metallic friction-rollers at the end. The ironwork is made of malleable cast-iron, and so combines the advantage of high magnetic power and of cheap production. Mr. Griscom, the inventor, styles his little machine the double-induction motor on account of the reaction between the currents in the armature and those which supply the outer field-magnets. The inventor originally intended his motor to be used with a 6-cell bichromate battery, and he claims that one single charge of acid liquid will last long enough to enable a sewing-machine fixed to a motor to accomplish from 500 to 1000 yards of stitching. But there is no doubt that the motors work equally well with currents supplied from any other source in adequate strength. A gold medal was awarded at the late Paris Exhibition to Mr. Griscom for the excellence of his capital little machine.

It will be remarked that in each of the little modern motors described a simple Siemens' armature is employed in preference to one in the form of the Gramme ring or other complicated pattern. This is simply a consequence of the difficulty of constructing these more complex kinds of armature cheaply on a small scale. If they could be as cheaply constructed they would doubtless be preferable as having no dead points, and therefore not being liable to stick at starting, though this rarely happens with these little electric engines. It will also be noted that the last two forms are dynamo-electric instead of magneto-electric; that is to say their fixed magnets are electromagnets of iron, not permanent magnets of steel. This is in order to gain space; for an electromagnet may be made far more powerful than a steel magnet of equal size, and therefore for an equal power the electromagnet will be of less bulk than the magnet of hard steel.

A CHAPTER IN THE HISTORY OF CONIFERÆ

THE PODOCARPEÆ

THE tribe is limited to three genera. Nothing is known as to the ancestry of two of these—*Microcachrys* and *Saxegothea*, represented now by a single species each; but the third, *Podocarpus*, comprises fifty-nine species according to Gordon.[1] The fruits are drupaceous or nut-like, and the seed generally possesses a hard shell and contains a dicotyledonous embryo. The leaves are either distichous, like the yew, or imbricated, and vary from very small to several inches in length; and although generally parallel-nerved, two species in the Kew Herbarium have distinctly dicotyledonous venation. Like the rest of the Coniferæ, some species form colossal trees, exceeding 200 feet in height. They are classified in the "Genera Plantarum" into four groups—*Nageia*, which contains the only Conifer indigenous to the East Indies; *Eupodocarpus*, comprising the vast majority of the species; *Stachycarpus*, and *Dacrycarpus*. The two latter sections are represented in the Eocene, and are at present limited to the Malay Archipelago, Australia, New Zealand, and South America. Notwithstanding their immense distribution and the evidence of vast antiquity which the genus presents, scarcely anything is known of their past history. In most cases the foliage when detached has little to distinguish it from better-known Coniferæ, and the fruits, in the fossil condition, seldom present anything by which their gymnospermous origin can be inferred. Except a doubtful and undescribed species from Aix-la-Chapelle, no podocarp is known of earlier age than Eocene, and they disappear from temperate Europe with the Oligocene. Like the Araucaria and other genera innumerable, they seem to oppose the theory that all plants have originated in northern regions, and passed south by way of existing continents; and unless it is supposed that their present distribution was accomplished prior to the Cretaceous, we are forced to admit, in order to explain their presence in Chili and other parts of South America, a land connection far to the south of that admitted by Wallace and those who share his opinions. No trace of podocarp has in fact been made known either from the Arctic or the American Cretaceous and Tertiary floras.

The fossil Podocarps that are known may be conveniently classified under two heads—those that have shed their leaves separately, and those that have shed them adhering to branchlets.

Of the former, various species have been described by Saporta, Heer, Unger, Ettingshausen, and others, ranging in time from the Suessonian to the lowest stage of the Aquitanian. They therefore form a group in Central Europe essentially characteristic of the Eocene, and are quite unknown in the Miocene, except in Italy. They occur at Aix, Lat. 43°, and extend up to about Lat. 48°, which represents their Eocene distribution as at present published. It may therefore emphasise the importance attaching to a proper examination of our British Eocene floras, when I state that they have now been found not only at Bournemouth, but in Antrim and in Mull, or as far north as about 56½°. The British species differs from all those previously figured, for it has a broadly sessile and articulated base, whilst the others are represented as tapering to a fine point. The leaves, though scarcely 2 mm. broad, sometimes reach 5 inches in length. Those from Mull, and, as far as can be seen, the half-leaf from Antrim, are specifically identical with the Bournemouth form, and this is the more remarkable since the latter is confined to the uppermost bed under the Coastguard Station, and has never been found in any of the other numerous beds from which I have so largely collected. Of the Continental species, the nearest to it are mostly from Aix, whose flora in several other respects presents the greatest affinities with ours. Besides the identity in appearance of some of the leaves with many existing Podocarps, as *P. andina*, the microscopic structure of the leaves and wood peculiar to them was recognised and explained by Unger. I have not seen any records of the fruits being found, and although some from Bournemouth might belong to the species, no essential character is preserved.

Of the Podocarps whose leaves are shed attached to branchlets, only the most insignificant traces have been hitherto known. I have now to add at least two species whose foliage, fruit, and flowers are preserved.

The first and most ancient is from Alum Bay, and has hitherto been supposed a Sequoia, a Taxus, a Cypress, &c., by distinguished Continental professors who have examined it. Possessing polymorphic foliage, it falls into the "Dacrycarpus" division of Hooker. By far the larger proportion of the foliage collected is distichous, being much smaller than that of the yew, with the bases of the leaves prolonged down and adhering to the stem, and with three out of the five rows, though still recognisable, reduced to small dimensions. This abortion of some of the leaves, in order to permit the remainder to expand into two lateral rows, is exceedingly characteristic of ancient Coniferæ, and still survives in Sequoia, being probably the precursor of the truly distichous arrangement seen in Taxus, Taxodium, Toveya, and other existing Conifers. The fruit is small, petiolated, and remarkable as occurring on the distichous branches. The fossils of Alum Bay were, unfortunately, collected principally for sale, and the unattractive imbricated branchlets and the insignificant-looking fruit were doubt-

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[1] Sir Joseph Hooker believes they may eventually be reduced to less than forty, since several are very imperfectly known.

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less passed over. The fruit I possess is attached to a branch, and was found during the last visit to Alum Bay on which I was able to collect any fossils, for within a few months of that time the leaf-bed disappeared with the recession of the cliff. It is the only Conifer known from Alum Bay, or even from the Lower Bagshot formation, and all others should be erased from the list.

The second species is from Bournemouth, and is known from even more ample material. The foliage is also dimorphic, the distichous type being however very subordinate and confined, as in *P. cupressina* and other living species, to short, simple branchlets. A complete seedling plant with its roots possesses an irregular distichous foliage something like that of the Alum Bay species, but becomes imbricated towards the root. The young plant seems to have retained this character for some time, as shown by several branchlets. It then appears to have assumed a semi-imbricated foliage, which is exceedingly graceful. The full-grown tree principally possessed imbricated foliage, and the position the distichous branchlets occupied can only be inferred from existing allies. The largest branch is about fifteen inches long, and is composed of about thirty branchlets; but this is surpassed in elegance by another seventeen inches long, whose stem is still imperfect. The simple branchlets are very slender, about six inches long, and were often shed singly, but both branches and branchlets, as I here term them, were, I think, articulated and shed naturally, and not broken off by wind. The fruit is a berry of about half an inch diameter, clustered in three, shortly stalked, and borne on an imbricated branch, and the male catkins are in pairs and terminal. The tree was probably of large growth, and pendulous. A third form, which I cannot assign with equal reason to any genus but Podocarpus, has larger foliage. Both of these types seem extinct, with their nearest allies in the Australian region and the Oriental Island region of Wallace.

In addition to these there are fruits from Sheppey which I believe to be podocarpous, one at least seeming identical with *P. elata* of Queensland. The whole of the forms will be published and fully illustrated by the Palæontographical Society in their usual exhaustive manner.

The study of the Tertiary Coniferæ, together with that of the ferns, has already led to some not unimportant rectifications. The Bovey Tracey beds have been exactly correlated with those of Bournemouth, and now the Mull, and I believe also the North of Ireland beds, can be clearly shown to be Eocene. I also hope in my next journey to Iceland to complete the correlation of the Tertiary beds there, and of Scotland and Ireland, with those of Greenland, which I cannot but regard, from whatever aspect they are viewed, as of considerably earlier age than Miocene. J. STARKIE GARDNER

NOTES

WE are glad to see in the recently published number of the *Journal* of the Linnean Society Mr. Bentham's important paper on the *Gramineæ*, giving the critical results of his examination of the leading groups and genera of that important family. Having been read so recently as November 3, 1881, it has been printed and issued to the Fellows with commendable rapidity. We understand that our distinguished English botanist is, notwithstanding his recent severe domestic affliction and his advanced age, in excellent health, and that he is daily engaged in the Herbarium of the Royal Gardens, Kew, in the continued preparation of the *Genera Plantarum*—the monumental work on the genera of all known flowering plants, of which the first instalment was published in 1862. Sir Joseph Hooker and Mr. Bentham have been occupied with its elaboration for the last quarter of a century, and it will be with feelings of no small satisfaction that all students of systematic botany will learn that the printing of the third and concluding volume will shortly be commenced.

MESSRS. MACMILLAN AND CO. will shortly publish an account of the late Prof. James Clerk Maxwell, by Prof. Lewis Campbell, of St. Andrews, and Mr. William Garnett, late Fellow of St. John's College, Cambridge. We understand that Prof. Campbell was Maxwell's intimate associate in early life, and Mr. Garnett was associated with him as demonstrator at the Cavendish Laboratory from its opening in 1873 until Prof. Maxwell's death in 1879. The work will consist of (1) a biographical outline by Prof. Campbell, with selections from correspondence; (2) by Mr. Garnett, a popular account of Maxwell's chief contributions to science; and (3) a collection of his poems, a few of which are already known to the public, while the greater number of them will now be published for the first time. The book will be illustrated with one or more steel plates of portraits, and a series of outline sketches of early scenes, done by Prof. Maxwell's cousin, Mrs. Hugh Blackburn (J.B.), from drawings made by herself at the time; also with coloured and other diagrams explanatory of his scientific work, some of which are taken from original water-colour sketches of his own. Not to dwell here on Prof. Maxwell's eminence as a man of science—the originality and depth of his character, his religious earnestness, his amiability, and his quaint ironical humour, may be expected to render this presentation of him by intimate friends more than ordinarily attractive to many readers outside the scientific world. The whole will be comprised in an octavo volume of about 500 pages.

UNDER the direction of the Trustees of the Gilchrist Educational Trust a course of scientific lectures by Mr. Lant Carpenter has just been given in five Lancashire towns. The total audiences were from 3500 to 4000 per week, chiefly artizans, who maintained their interest to the very end—the same people coming night after night—and in some instances going to another town in the same week to hear the lecture over again. The lectures were well illustrated by experiments and by the photographic diagrams, &c., in the oxhydrogen lantern. The latest developments of science were treated of, including the storage of energy and the electrical transmission of power. At the close of the course, hearty votes of thanks (with requests for other courses) were passed to the Gilchrist trustees and to the lecturer.

THE staff of the Russian observing station on the Lena left St. Petersburg on December 27. MM. Yurgens and Eigner are intrusted with the astronomical, magnetical, and meteorological observations, and Dr. Bunge will make researches in zoology, botany, and geology. They expect to reach Irkutsk with their instruments, in two months, and to begin next spring their journey to Yakutsk, so as to be able to open the polar station at the mouth of the Lena, on August 1, 1882.

THE rate of the cricket's chirp varies with the temperature, becoming faster as the latter rises. Recently a writer in the *Salem Gazette* (Mass.) gave the following rule for estimating the temperature of the air by the number of chirps made by crickets per minute:—"Take seventy-two as the number of strokes per minute at 60° temperature, and for every four strokes more add 1°; for every four strokes less deduct the same." In a letter to the *Popular Science Monthly*, Margarette W. Brook gives an account of observations she made with a view to testing this rule, on twelve evenings, from September 30 to October 17. Her column of temperatures as computed by the rate of vibration shows a close agreement with that of temperatures recorded by the thermometer.

THE industrial manufacture of oxygen has engaged much thought, while the uses, on a large scale, of that agent have not been very exactly determined. At Passy there are now works

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